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ROCKS and MINERALS

A Magazine for Mineralogist, Geologist and Collector . . .

. . . . . Official Journal of
The Rocks and Minerals Association

.. JUNE, 1937..

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ROCKS and MINERALS

PUBLISHED MONTHLY

Edited and Published by PETER ZODAC

JUNE ..1937..

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Entered as second-class matter September 13, 1926, at the Post Office at Peekskill, N. Y., under the Act of March 3, 1879.

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Specially written articles (as Contributions) are desired.

Subscription price $1.50 a year; foreign $1.75. Current numbers, 15c a copy. No responsibility is assumed for subscriptions paid to agents and it is best to remit direct to the Publisher.

Issued on the 1st day of each month.

Authors alone are responsible for statements made and opinions expressed in their respective articles.

ROCKS and MINERALS PEEKSKILL, N. Y., U. S. A.

The Official Journal of the Rocks and Minerals Association

CHIPS FROM THE QUARRY

(Formerly the Bullettin Board)

R. E. Myers to Represent R. & M. A. at Moscow

Mr. Richmond E. Myers, Director of Tours of the Rocks and Minerals Association, has been appointed to represent the Association at the Seventeenth International Geological Congress to be held at Moscow, Russia, July 20th to 29th, 1937.

Mr. and Mrs. Myers will sail on the "Europa," Saturday, June 19th, and plan to return in September. We shall hope to print an article or two on some of the mineral localities visited by Mr. Myers, during the Congress, in due time.

Extensive trip planned

Mr. and Mrs. James A. Taylor and their two sons will make an extensive mineral trip through Quebec, New Brunswick and Nova Scotia, all in Canada, during the month of July. If the trip proves successful from a mineral standpoint, we believe Mr Taylor can be induced to write it up for *Rocks and Minerals*.

Mr. Taylor is a prominent attorney in New York City but whose residence is in Glen Ridge, N. J.

A Mineral Club For Wyoming

The first mineral club in Wyoming was organized Tuesday, April 20th, 1937, when about 50 people from Lander, Hudson, Riverton, Ft. Washington and Wind River met at the Fremont County Vocational High School in Lander. The meeting was a most successful one and prospects for a flourishing club look very bright. An official name for the club has not yet been adopted. The officers elected were: N. H. Brown of Lander, Honarary President; L. B. Curtis of Lander, President; Henry Conant of Riverton, Vice-President, and L. V. Abbott of Lander, Secretary.

Meetings of the club will be held on the Tuesday night following the third Sunday of each month

Who Will Oblige?

Rocks and Minerals is desirous in obtaining a number of articles for some special quartz numbers on amethyst, geodes, jaspers, etc. We have so far a short article on an amethyst occurrence in Maine; three good articles on geodes in Iowa and Ohio; and one good article on jaspers of the Mohave Desert, California. Who can supply information on occurrences in other states or countries? An article on minerals found in geodes would be especially appreciated.

We can use articles on any type of quartz.

The Agate Shop

C. L. Clinton's lapidary shop, 29 Southside Ave., Somerville, N. J., will be known hereafter as "The Agate Shop."

TEN MINERAL COLLECTORS

Ten mineral collectors hiked to a mine
One fell down a shaft then there were nine.

Nine mineral collectors sorry to relate
One slid down a hole then there were eight.

Eight mineral collectors looking up towards heaven
Bang fell a rock on one then there were seven.

Seven mineral collectors thinking up some tricks
One hid in a sump then there were six.

Six mineral collectors, very much alive
One got blown up then there were five.

Five mineral collectors, one was a bore
He was chased home again then there were four.

Four mineral collectors dancing in great glee
One became exhausted then there were three.

Three mineral collectors, one was named Lou
He got lost on a dump then there were two.

Two mineral collectors, one had a gun
Along came a cop, then there was one.

One mineral collector, trying to have some fun
Held a fuse in his hand, then there was none.

A New Bulletin

W. Scott Lewis, 2500 N. Beachwood Dr., Hollywood, Calif., has recently put out a Mineral Bulletin which will be issued 10 times a year and sent free to all his customers. He reports that the Bulletin is being very favorably received.

ROCKS and MINERALS

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VOL. 12 No. 6

The Official Journal ROCKS and MINERALS of the ASSOCIATION

WHOLE No. 71

A COLLECTION TRIP TO CUMBERLAND AND DURHAM COUNTIES, ENGLAND, IN 1912

By PAUL WALTHER

Easter was about the middle of April and the weather promised to be fair for the holidays. I had not been to Alston (Cumberland), the highest situated town in England, for nearly a year and therefore decided to try to find a few more mineral specimens on the dumps of the long abandoned lead mines on the Alston Moor and the newly opened mine at Nenthead and Nentbury. I was able to persuade a friend to come along and on a Thursday afternoon we took the train which runs due west from Newcastle along the river Tyne to Carlisle on the west side of England. We left the train at Haltwistle and boarded another train which runs from there up into the Alston Moor district; the whole journey took about an hour. There the train stops and returns to Haltwistle.

After engaging a room and having our supper, we went to the bar to inquire about some people I had met before. Here we met an old miner who told me about a mine which had been opened in the hope of finding a deposit of witherite but after going in for about 30 yards it was abandoned because the material found contained too much limestone. We found the place about two miles from town and there was a small dump consisting of blocks of a yellowish gray mineral with quite a lot of crystals in the cavities. The place was the famous locality for barytocalcite. Now began two hours of hard work to get a number of some good druses of barytocalcite. One block of that mineral was hollow and thickly coated with glassy crystals which showed the same form of crystallization as some of the other yellowish gray crystals. According to the textbooks, the barytocalcite ought to have been colored and only translucent instead of clear and colorless. (At home an anlysis proved the crystals to be barytocalcite.

Back to the inn, dinner, and then along the Nent River to Nentbury mines to call on my friend, the manager of the place. The mine was worked for lead and witherite. I had been exchanging with the manager, who was also a collector, and got from him a druse of witherite crystals which ended in a perfect base (C). A mile or two from there we came to the Nenthead mine. This mine had been worked, years ago, for lead only; the sphalerite which was plentiful had been thrown out on the dumps because the miners did not know what to do with it. At my time, the mine had been taken over by the Vioile Montagne Zink Company to work over the sphalerite dumps and the old deposits of that ore. Galena was of course still found there in fair amounts. In looking over the ore piles, I found a large lump of ore on which were some large crystals of galena built up from small crystals. I broke one off and found it to be only

a thin hollow shell containing inside minute, clear yellow crystals. These proved on examination to be sulphur crystals and had been formed by the decomposition of the galena. I found a few pieces of fluorite with translucent crystals of about ½ inch but these were not worth taking along. As my ruck sack by this time felt rather heavy, we took a traps to bring us over the Kilhope to the Weardale, where I usually stopped at the Weardale Hotel. The owner of that house had a trap rock quarry about a ¼ mile away; his wife took care of the hotel. A few weeks before our arrival, they had discovered at the quarry a cavity filled with pectolite and I received from him a nice specimen of long, fibrous material; the fibers ending in half-rounded balls. I went over to the quarry and met there one of the workmen who brought me ½ dozen more pieces of pectolite, all ending in those peculiar globules. He told me that his brother had about 10 pounds more of the pectolite and that I could have the lot for 20 shillings. I paid the man on trust and made an excellent bargain. One piece was 4x12 inches, covered on the top with those balls, and three pieces which were covered with columnar crystals of apophyllite. The crystals which coated the balls of pectolite all over were apophyllite too. (We find sometimes at West Paterson, N. J., pectolite globules covered with a thin skin of a red or yellowish minute crystals of apophyllite also).

The find of the pectolite was quite unexpected as my trip to Weardale was planned only to visit the lead and fluorspar mine in its vicinity. We naturally went to the mine and called on the manager. At that time, about 23 years ago, good crystals of pale purple fluorite were not very rare, even if the time when one could get perfect cubes of pale purple fluorite crystals of 2x4 inches diameter, was over. I was always able to get there beautiful druses with crystals of 1 inch and over. Then there was pearl spar, beautiful specimens of white dolomite with a pearly sheen.

Sunday evening we took the train from Wearhead to Stanhope. We had no time to visit the Rookhope mine where deep purple fluorite crystals of 2x3 inches in diameter were found. Stanhope who had a lot of fluorite crystals and was therefore certain that I should be able to get as many loose crystals as I wanted. My main reason to visit Stanhope was to get some green fluorite "chlorophane." This material came from an old abandoned mine near Stanhope and I was only able to get two good druses. I could have gotten quite a lot of loose, small crystals of about ½ inch and less in diameter but I did not care for them at that time. Now I wish I had a dozen or so. Of calcite I got a fine skeleton druse of rhombic crystals which had originally coated fluorite crystals, but the fluorite had been leached out and only the calcite coating had been left and further, two sides of a former coating of yellow-gray dolomite on a large 10-inch crystal of fluorite. In both cases the fluorite, which resists most acids, had been leached absolutely out by alkaline solutions in the earth while the calcium or magnesium carbonates had remained intact. A similar occurrence had happened on a specimen I found on another trip to Nenthead only in that case the shell consisted of quartz crystals, which had originally coated a group of fluorite and after the leaching out of that mineral left a perfect transparent shell of quartz crystals which rests on a druse of sphalerite crystals.

Having gotten all I could expect, we took the afternoon train down the pretty Weardale to Durham, with its medieval castle and old abbey, and went home again by the London-Northeastern train to Newcastle, happy with the splendid results of our four days' trip.

GOLD

JONATHAN McC. BLAIR

Introduction

Iron is heaped in mountain piles
And gluts the laggard forges,
But gold flakes gleam in dim defiles
And narrow gorges.
—J. G. Holland—"Bitter Sweet."

There is more general interest in gold than in any other mineral found on earth.

Gold is a very handsome and showy mineral, especially when associated with snow-white milky quartz. Very fine specimens of leaf gold in milky quartz are found in Australia.

Naturally crystallized gold is often suitable for wear as a lapel ornament just as found. Very handsome specimens are found in Placer County, California., usually as an aggregate of interlocking pseudorhombic forms, the whole simulating a fraternity pin.

Historical

Gold was the first metal to be used by primitive man, since it is found in the beds of streams to which men came for water and which were their highways from earliest times. Its glitter and bright color quickly attracted the attention. When once its acquaintance was made, it was easily recognized again, since it did not tarnish or rust, was very heavy, and so soft and malleable that it could be easily worked into various shapes, which, because they did not tarnish, became permanent ornaments. These qualities led men to use it long before they noticed or used the more abundant metals. Gold was contemporaneous with the Stone Age, preceding the Bronze Epoch and the subsequent Iron Epoch of prehistoric man.

The famous ark of the covenant used in worship by Moses and his people was generously covered with gold. Gold was familiar in the time of King Solomon, who used it lavishly in his temple. King Solomon obtained it from the Land of Ophir. Where is the land of Ophir? Go to Ethiopia and ask the Old Man of the Mountain, dread Solomon Ghogoli, Sultan of the Shangul. He is over a hundred years old, maintains many wives, and has a retinue of murderous warriors and head-hunters. He admits the supremacy of no other ruler; now that Haile Selassie is deposed. He is the absolute monarch of the forbidden land of the Blue Nile, that remote western desert region which is the "back door" of Ethiopia. In this legendary land are enormous canyons and great mountains. It is always 140-160 degrees in the shade, sometimes 167, three-fourths as hot as boiling water. These mines are somewhere in the vicinity of the Yabus river, and the nearest Ethiopian village is Albi Moti. Only one living white man has ever seen them, and that is Count Byron de Prorok, American explorer and archaeologist. He climbed a great mountain and found that its approximate center was the huge crater of a smouldering volcano. From the rim on the far side he beheld an amazing sight through his binoculars: 1,000 feet below, untold thousands of black slaves, both men and women, were toiling to unearth gold nuggets from the bed of a subterranean river. Some of these nuggets were the size of a man's fist. That this district was the seat of a very ancient civilization is quite evident. In the canyons near the mines are many abandoned mine shafts, with ancient hieroglyphics and rock drawings on the entrances. There are many tombs in this region. Solomon Ghogoli possesses valuable golden idols, dating back many centuries, which his slaves have dug up in the surrounding region; also a number of huge rough diamonds. These mines are the original King Solomon's mines of the Land of Ophir, which supplied the gold of the fabulously wealthy monarchs of ancient times: Tut, Solomon, the Queen of Sheba, Hannibal, Cleopatra, and Alexander the Great. No doubt the rediscovery of this oldest and richest of gold mines was one of the secret but prime causes of the Italo-Ethiopian war.

Gold is associated with the very earliest civilizations, being found in such ancient tombs as those at Kertsch in the Crimea; in North Africa; and Asia Minor. Cloisonne work made in Egypt 3000-4000 years ago shows

skillful craftsmanship in the use of gold. In America, the Indians, especially to the south, were using it long before the continent was discovered.

De Soto, in his expedition of 1538-40, visited a province which is now known as North Carolina. At the time of the Spanish invasion, this province was ruled by a beautiful Indian queen named Qualla. Here De Soto found trinkets and ornaments of gold, and tomahawks formed from an alloy of gold and copper, and his adventurers were wild with the thought that a great gold lode must be near. But they searched in vain, and finally went away disappointed. The Indians kept their secret. The white men did not know that less than 15 miles from them, on the Carolina side of the Savannah river, lay one of the richest gold deposits in the world. In 1820 this deposit was discovered by Americans and mining operations were commenced. Within 10 years the annual output was close to one-half million dollars. At Charlotte, a U. S. mint was established to coin the gold conveniently.

Composition

Gold forms very few compounds, but has a considerable tendency to make alloys. In Nature, gold is never entirely pure, but is an alloy, usually with silver.

All gold contains silver in solid solution. As the amount of silver increases, the alloy becomes paler, lighter, and more liable to dissolve in nitric acid. Most Hungarian gold contains 30% silver, California gold 10%, Australian gold (Mt. Morgan, Queensland), which is the purest, only 0.03%.

Gold contained in pyrite and other metallic sulphides is so finely divided as to be invisible. It is mechanically included in the sulphides and not chemically united with the sulphur.

Another alloy fairly abundant in Nature is that with tellurium, such as calaverite (AuTe2). Another combination includes gold, silver and tellurium, sylvanite (AuAgTe4). Such combinations are known as tellurides. Calaverite is mined as a source of gold at Cripple Creek, Colo., while sylvanite is an important gold ore in South Africa.

Tenacity

Of all the metals, gold is the most malleable and its ductility is remarkable, for one grain (less than the size of a pin head) can be drawn out into a wire 500 feet long, wire as dainty as the finest spider's gauze. It can easily be beaten cold into a thin translucent leaf as thin as 1/250,000 inch; thus one grain can be spread over 56 square inches.

Fusibility

Gold melts at 1200 deg. C. (2016 deg. F.) and forms such perfectly spherical globules that by microscopical measurements it is possible to estimate the amount of gold in a globule and hence to dispense with fine balances in assaying.

Pyrognostics

Sulphur and oxygen do not unite with gold, and hence it remains bright in Nature or when worn as an ornament. Fiction stories in which chests of gold are described as being blackened with age when brought to light are obviously fallacious, and indicate a deplorable lack of knowledge on the part of the author, deplorable because it spoils the verisimilitude of an otherwise good story. This same criticism applies to most fiction which have precious stones in the rough included in the theme matter, which are often absurdly described. While no one would be hypercritical enough to condemn a good story on such little details, yet the authors themselves seek the greatest degree of verisimilitude possible.

Common acids have no effect on gold, but chlorine or nitro-hydrochloric acid will corrode and dissolve it, forming gold chloride, which is very soft and putty-like and can be dissolved in water.

Differentiation

Readily recognized by its opaque metallic gold-yellow color, considerable weight (15.6-19.3), softness (2.5), malleability, and the fact that it does not tarnish.

Prospecting—Panning Gold

Pick out a likely gulch. Then take a gold pan. Fill it with the mud and gravel from the stream bed, or the bank where the water sweeps round in a curve and where its retarded speed may have caused it to drop any heavy particles of gold that it was carrying along its course. The beginner should use care and cau-

tion in panning. Take your time. Too fast or careless panning may cause one to slough off with the muck and worthless gravel those few tiny specks of yellow metal which tell the tale, which announce as clearly as printed type to the man who knows the signs that he is on the trail of "pay dirt." Any earth which yields 10 cents worth of gold to the pan is known as pay dirt; 15 cents to the pan is good; 20 cents to the pan is rich. About 40 panfuls can be washed out by one man in a day. Thus 20-cent pay dirt would yield $8 a day.

A good serviceable pan for routine work is one having a bottom diameter of 14 inches. They are made of steel and should cost, through mine supply companies and hardware dealers in the vicinity of mining country, $1-$1.50.

Don't fill the pan too full. Half full is plenty, as a rule. Pick out a spot along the stream where the water is flowing in comparative quiet and yet where it is deep enough to enable you to keep the pan completely immersed while working it. Dig out a little pool to do your panning in if the stream is too shallow otherwise. First sink the pan, rest it on the bottom and let the contents thoroughly soak. Work up the sand and gravel with your hands. If much clay is present, rub it carefully into a watery mass and knead it thoroughly. Let the clouds of fine silt wash down the stream, carried away by the current.

When you have worked up the contents, grip the pan at opposite sides and, holding it level under the water, give it a number of rapid half turns. Some of the strain can be avoided and a better, easier swing imparted to the dish if the circular motion is made to come from a free shoulder swing rather than a jerky elbow twist. Keep up the rotary swing until the coarser particles gradually work up to the top of the heap and the finer sediment settles to the bottom of the pan. At this stage it is safe to pick out the larger pebbles and stones by hand and discard them. Then press the pan under the water again and repeat the twirling motion. More coarse gravel will rise to the top. Pick it out, too. Now you are getting down to the real business. Not much left in the pan but fine sand, black sand and the gold or other heavy precious metals—if any.

Push the pan under the water once more, give it a few vigorous half turns for luck and gradually tilt it until it slopes away from you at a low angle. This will bring the contents to the lower edge of the pan. Keeping the pan slanted, swing it away from you and towards you—three to four inches each way. Take care that you don't jerk the pan, as a sudden harsh movement might cause particles of fine gold to be carried over the lip with the sand. Swing it with a steady easy stroke. Let the force of the water wash the sand over the lip, not the steepness of the tilt.

Every once in a while bring the pan back to a level position again, then resume the tilting operation. As the contents begin to dwindle, use greater care.

When only a few spoonfuls of sediment remain, fill the dish nearly full of water and take it out of the stream. Let most of the water run off at a low angle. Now by a gentle rotary wave action make the water circle around the residue left in the pan. Fan it out this way. The sand will roll ahead, behind it most likely will stretch a thin streak of black magnetite sand, and lagging behind that your gold. A few small specks—colors the size of tobacco grains—and possibly a tiny nugget or two.

If you are not in gold country and just want to practice, or if you want to check up on your recovery results, "salt" your pan with a few small lead pellets (or a handful of shot varying from the finest bird shot to BB)—count them or carefully weigh them, and mix them in with some coarse sand, some gravel, and a little clay or mud —and go ahead with your panning. If you don't lose any of the lead pellets in the operation, it is a cinch you are not losing any possible gold values. But if you come to the end of your pan and find the lead gone, something is wrong, badly wrong. You are probably washing the sand over the lip of the pan too vigorously and letting it carry any possible values away with it. The quicker you can pan without loss the better gold miner you are.

A "cradle" is often used in placer mining. This is a long box. At the

top is a sieve which sifts out the stones. Nailed to the bottom are "riffles" (small cleats of wood), which prevents the water from running so fast as to sweep the gold out of the cradle with it. The device is placed on rockers, and is tilted slightly. One man shovels the gravel into the top of the cradle, and his partner rocks it. The sieve holds back the stones, the water breaks up the lumps of earth and gravel, and washes them down the cradle. The grains of gold are stopped by the riffles, and sink to the bottom.

If a creek is consistently a dud, move to the next one. And don't look only for placers. Keep an eye out for outcrops of ore deposit.s Examine the contact lines between different classes of rocks. Look for veins that may carry gold, and when you find one that looks auspicious — rusty, weathered, iron-stained quartz is often a good indication—take one to two pounds of the rock back to camp with you. Look it over thoroughly with the naked eye and with a magnifying glass, to see if you can find any colors of free gold in it. If you do, grind it up as fine as you can in an iron mortar with an iron pestle. Take your powdered rock, dump it carefully into a gold pan, go down to the creek and pan it carefully. Perhaps you'll catch some colors of free gold in it. If you do, stake your find, record it at the nearest recording office and send samples of the ore to a reliable assayer for a proper quantitative estimate of the amount of gold per ton the rock contains.

Even when examination with a glass fails to reveal gold, if the rock is abnormally heavy, grind it up and pan it anyhow. There is quartz in Idaho which looks lean—pure white solid quartz with not a spot of gold to be seen in it anywhere—which when ground in a hand mortar and panned yielded from almost every handful a little trail of yellow metal dragging behind when the residue in the pan was finally fanned out.

Recovery

When the broken rock of the gold mine is raised to the mouth of the shaft, it is sent in cars to a stamping mill. Here the ore is fed into a great steel box called a "mortar." Immense hammers, often weighing 1000 pounds each,. drop down upon the ore, one after another, until it is fine enough to go through a wire screen in front of the mortar. When several hundred of these hammers in the larger mills are pounding away, a stamping mill is a very noisy place. The ore, crushed to a fine powder, is now subjected to either amalgamation or cyanidation.

In amalgamation, the crushed ore runs over sloping tables covered with copper. Sticking to the top of the table is a film of mercury. This holds fast all the gold grains by amalgamation, and unites them in a mass, which is scraped off from time to time. Later the golden plaster (amalgam) is subjected to enough heat to vaporize the mercury and leave the pure gold behind.

In cyanidation, cyanide is mixed with water to form a strong solution, and into this the crushed ore is thrown. The cyanide element in the water causes the gold to dissolve and the false rock to sink to the bottom. The water with the gold in solution is then run into boxes filled with zinc shavings. The gold particles cling to the shavings like a burr to a dog's tail, giving them a sort of gold plate. The shavings are finally placed in a furnace, which causes the zinc to melt first and run off, leaving the gold free.

Production

South Africa yields over half the annual supply of gold. Supplemented by the Australian fields, also Canada, India, British Guiana, etc., this gives Great Britain the balance of power in gold production.

Suppose, while the United States were off the gold standard, the British Empire worked her gold mines to capacity production, and at the same time went on the gold standard. Would this break the financial power of the United States, already weakened by a severe economic crisis? In these peculiar times, this is something to give thought to.

Trade

Jewelry is marked by "carats" (k), a "carat of gold" being an old-time weight equal to 1/24 troy ounce. Pure gold is spoken of as being "24 carats fine"; therefore, if you have a ring marked "14 k" you know that 14 parts of it are gold and 10 parts alloy

(14 plus 10 equals 24 parts). Jewelry of a bright yellow color denotes silver alloy, which is the most durable. If the yellow is quite deep you may confidently believe that copper has been used.

Jewelers' Alloys

White gold: 100 silver or 100 platinum.

Red gold: 3 parts gold plus 1 part copper.

Yellow gold: 100 gold.

Green gold: 3 parts gold plus 1 part silver.

Blue gold: 3 parts gold plus 1 part iron.

Gray gold: 85.7 gold, 8.6 silver, 5.7 iron.

U. S. gold coins are alloys of 9-11 parts gold plus 1 part copper, to give them greater durability.

The wedding ring is always worn on the third finger of the left hand.

Care

If a gold ring happens to tarnish suddenly, many people jump to the conclusion that they have been cheated. But there are many other possible explanations. Sometimes an excess of acid in the perspiration from the skin will attack the alloy and discolor it. Other substances that may have a similar effect are sulphur, rubber, iodine, ointments containing mercury or arsenic, hair dyes, certain complexion lotions, and many solutions used for cleaning fabrics and leather.

Comparative

The largest nugget known was the "Hill End," found in New South Wales, Australia. It measured 4 ft. 9 in. x 3 ft. 3 in., averaging 4 inches in thickness. It was valued at $148,000.

The second largest was the "Welcome Stranger," found in Australia. It measured 10 x 21 inches and weighed 2280 oz. Its value was $47,670.

The third largest was the "Welcome," found at Ballarat, Victoria, Australia, in 1858. It measured 20 x 12 x 7 inches, weighed 2159 oz., and was valued at $46,625. When found this nugget was 180 feet down, in white quartz, was irregular in shape, and much honeycombed by the action of water. (This nugget is frequently described as the largest.)

An unnamed nugget found in Australia weighed 1743 oz. 13 pwt., valued at $34,525.

An unnamed nugget found in Siberia was valued at $30,000.

A nugget found at Ballarat, Victoria, Australia, weighed 1619 oz. and was valued at $27,660.

The "Ural" nugget was found in Siberia, value $24,000.

A prospector named Martin found a nugget in California (erroneously ascribed to Arizona) weighing 80 lb. (not 151 lb., as sometimes described). Martin and a comrade were encamped in a canyon, when a cloudburst caused the stream to rise so rapidly that they were caught. The comrade was drowned but Martin escaped death, though severely injured. After the torrent had subsided he returned to bury his friend, whose body he found lodged under the roots of a tree. In dislodging the body he saw beside it the huge nugget. Its value was $22,700.

California: 420 oz., $12,300.

Siberia: "The Tzar," $11,000.

California: A quartz and gold boulder, $9,103.25.

California: Two nuggets worth $9,000 each.

Mexico: The largest known nugget from Mexico weighed 468 oz., valued at $8,430.

Ballarat, Victoria, Australia: A "golden wire" four feet long with attached lumps of egg size, $7,500.

California: $6,200.

California: A boulder yielded $5,700.

Nevada: The largest nuggest found in Nevada weighed 24 lb., worth $4,000.

Montana: The largest nugget found in Montana was worth $3,356.

California: $2,250.

California: A boy found a nugget worth $1,800.

New Mexico: The largest nugget found in New Mexico was worth $1,300.

Yukon: The largest nuggest found in the Yukon weighed 72 oz., $1,158.

Arizona: The largest nugget found in Arizona was worth $900.

Klondike: The largest nugget found in the Klondike weighed 34 oz., $538.

California: $520.

Colorado: "Tom's Baby" was the largest nugget found in Colorado, 13 pounds.

North Carolina has produced more nuggets from a single claim, the Reed mine, Cabarrus County, than any other place in the world. The weights are 28, 22, 17, 16, 13½, 9½, two 9, two 8, 5, 3½, two 2, and 1¾ pounds respectively; and a peck of golden beans and peas. Albemarle, Stanley County, is next richest. Nuggets of 10½, 8½, 5¾ pounds respectively, a dozen of one pound each, and two quarts of smaller ones.

The largest known nugget from South America was one of 60 pounds from Peru.

Genesis

Nothing is known as to the origin of gold. The same may be said in regard to all the elements, except special radioactive series, which are phases of radioactive transmutation. All that is known is something of the method of their transference and deposition.

The ultimate source of gold is from the lighter-colored igneous rocks, as granite, syenite, diorite, throughout which it is diffused in quantities too small to be either visible or worth while to extract. It becomes available only when it has been dissolved out by percolating waters and segregated in fissures or veins, either in or leading from these igneous rocks. Generally this transfer of gold has taken place when the rocks were at high temperatures, and by the aid of water and other solvents, which was also at high temperatures.

Gold in solution, as a telluride, chloride, or cyanide, was carried by waters and deposited by them upon neutralization, cooling, or evaporation. Though the surfaces of gold crystals are rounded and often look as if melted, their appearance is not due to fusion but to their manner of crystallization. The origin of gold is the same as the origin of the vein material inclosing it—quartz, fluorite, and calcite. All of these minerals are commonly deposited from aqueous solutions.

The presence of gold in sandstone, limestone, etc., is secondary, as is also its presence in many fresh waters and all sea waters. Sea water contains gold in appreciable quantities, there being nearly one grain of gold (five cents worth) in every ton of ocean water. Then in all the oceans there is 75 billion dollars worth in the water alone, disregarding the prodigious amounts that are in the bed-rock of the ocean floor at various points.

Occurrence

The rocks in which gold-bearing veins are found are igneous or metamorphic. The richest veins are usually at the contact of different kinds of rock. A vein of gold is the most uncertain thing in the world. It may be quite thick where first struck, and then as you begin to go down into it, it may run thinner and thinner, and finally play out entirely. On the other hand it may be very thin where first uncovered, and then grow wider and richer as you follow it down. Often in a comparatively narrow streak, great bulges or swellings—called "lodes"—will occur here and there, like balls on a spindling chair leg. Such lodes are pockets of the finest treasure.

Most of the original discoveries of gold have been in placer deposits; and from them it has been traced back to the ledges from which it originally weathered.

Like diamonds, gold has been able to withstand the friction to which it was subjected while being washed from the original ledge. Diamonds resisted the friction because of their hardness; gold because of its tenacity; both have endured because of their insolubility and slight affinity for oxygen. The condition of gold in alluvial deposits varies from dust of microscopic fineness to nuggets many pounds in size. The largest nuggets have been discovered in Australia; some weighing 100 to 300 pounds.

The origin of nuggets of such size is a matter of much speculation, since no masses of similar size have been found in veins. It has been suggested that small particles carried downstream were welded together by the impact of water-tossed gravel until a large nugget was formed, or that the nuggets have grown by accretion of gold from some percolating solution. Polished and etched surfaces of nuggets, however, show crystalline structure. This would be wanting in welded gold, and there is an absence of the onion-like structure that would be expected if the gold were deposited by accretion from solution. Hence it may be concluded that the nuggets

were originally in quartz veins and have been rounded in the downward journey from some high ledge to the resting-place in which they were discovered.

The author ventures the opinion that these exceptionally large Australian nuggets are surface debris from overlying formations which have long since been eroded away, pre-existent geological formations, and that there probably is no such thing as the original ledge extant today. Their large size may be due to concentration and multiple reprecipitation, accompanied by recrystallization, thus perpetuating the inherent crystalline structure, from five hundred to several thousand feet of destroyed overlying strata, much after the manner of the concentration minerals in vugs of Niagara limestone at Rochester and Lockport, N. Y., which also are due to erosion of former strata.

Foreign Localities

Fifteen miles from Guyong, New South Wales: Original site of the discovery of gold in Australia, in 1851.

Ballarat, N. S. W.: A gold center.

Bendigo, N. S. W.: A gold center.

Castlemaine, N. S. W.: A gold center.

Mt. Morgan mine, Queensland, Australia: Opened in 1886, this wonderful mine proved to be literally a mountain sandwiched with gold. At once it began paying dividends of two million dollars a year and in 1921 it was still producing that much gold, but added to this immense profit was another one now derived from great deposits of copper which were unearthed by the company in the same mine.

Rand mines, South Africa: These mines, owned and controlled by the British Government, have proved the greatest gold find of history. In 1918 they produced over half the world-supply of mined gold. The mines are being worked conservatively, with no attempt to get as much as possible in the shortest time and thus flood the world's gold market.

THE HOMALODOTHERIUM

The world's only practically complete specimen of the skeleton of a large prehistoric animal known to scientists as homalodotherium has been recently added to the fossil mammal exhibits at Field Museum of Natural History, Chicago, Ill.

Installed with the reassembled skeleton is a model, one-fourth natural size, showing the rare and strange creature as evidence indicates it must have appeared when living, during the Miocene period, about fifteen million years ago. Reconstruction of the skeleton is the work of Preparator J. H. Quinn of the museum's division of paleontology, and the model was made by Preparator Phil C. Orr.

Homalodotherium was a South American animal, and the museum's specimen was discovered by Elmer S. Riggs, associate curator of paleontology, while leading an expedition in Patagonia. Nature had preserved the bones in blocks of sandstone which had fallen from the face of a cliff and were at the time of discovery being rapidly worn away by waves on the beach along the eastern shore of Patagonia.

Previous to this discovery, very little was known of this species of animal, as only fragmentary specimens of the skull, foot and leg had been found. Study of the nearly complete specimen has made possible the visualization of the animal in life, and the determination of some of its habits. Homalodotherium is thus known to have been a sturdy, heavy-bodied, strong limbed animal, as tall as an ox, but shorter in neck and body. Its head was similar in proportions to that of certain extinct members of the rhinoceros family. It had grinding teeth fitted for feeding on vegetation. The animal was entirely without tusks or horns as a means of defense. The forelegs were long, and the bones had the peculiar structure observed in animals that dig. The broad forefoot was armed with stout claws which clearly were used for digging. The hind legs were well adapted for supporting the animal while digging, and may have enabled it to rear upright to feed from trees also.

MINERALS OF LEADVILLE, COLORADO

By ALLAN CAPLAN

Box 144 Boulder, Colorado

Of all the past history of the mining districts in Colorado, the most glamorous, was that of Leadville, which lies in approximately the north central part of the State. The city of Leadville, which is in Lake County, is situated at an elevation of 10,150 feet above sea level. It lies between the great mountains of the jagged, bare peaks of the Sawatch Range to the west, and the broader, oval-shaped mountains of the Mosquito Range to the east.

The history of Leadville started in the spring of 1860, when parties of prospectors were exploring the headwaters of the Arkansas River, which flowed through the valley between the two mountain ranges. Rich placer ground was found in California Gulch, and the news spread rapidly throughout the rugged and desolate region. Approximately four months after the discovery, it was estimated that 10,000 persons inhabited the camp, and during that same summer nearly $2,000,000 worth of gold was taken from this small area. Some of the miners obtained $80,000 to $100,000 worth of gold in a single summer season's work. Kellog and Tabor made as much as $75,000 in six days' by working their own claims alone. Tabor later developed into the most picturesque character of early mining in the West, for the millions he acquired through Leadville mining advanced him to such political offices as state senator and lieutenant governor of the state.

By 1868 the miners realized that the heavy boulders which hindered sluicing was actually high-grade silver-gold ore existing with lead carbonate. Lode mining developed rapidly in the neighboring Carbonate, Fryer and Iron Hill regions as the result of an extensive period of trenching and shaft digging. The advent of the railroad and the smelter boomed this area into one of the greatest producers of silver and gold ore of its time. Today the camp has dwindled to a region of minor activity in the production of the state. The hills dominating California Gulch are now stuccoed with enormous dump piles and dilapidated buildings, indicating the great activity which existed in the past.

GEOLOGY

In brief, the country rocks of the region include sedimentary, igneous, and metamorphic formations; the last is composed of the pre-Cambrian basal complex upon which rest the other formations. The Paleozoic sedimentary formations attain a total maximum thickness of 1600 feet ranging in age from Upper Cambrian to Pennsylvanian. Intrusive porphyry in the form of dikes, sills, and irregular masses have been injected into the sedimentary formations. Later the sediments and porphyries were slightly folded and faulted. Erosion has cut into the intruded Paleozoic beds, and the final topographical development was the deposition of a heavy mantle of Pleistocene formations.

The ore bodies are grouped mainly as veins or lodes, and replacement blanket deposits in the Paleozoic limestones. Minerals formed by ascending ore-forming solutions (hypogene minerals) are commonly altered to other minerals as the result of descending waters (supergene minerals). The hypogene mineral deposits are brought nearer and near to the surface by the agencies of erosion until they come within reach of downward circulating waters, and oxidization takes place. Some minerals, particularly the gangue minerals, are little affected by this oxidizing process; such minerals as quartz and barite are only slightly altered. On the other hand, other minerals are rapidly altered, and they are converted into oxide minerals which remain in

the oxide zone, or are dissolved and carried to greater depths to develop into the zone of secondary enrichment in the form of sulphur-bearing minerals.

MINERALS

Sphalerite, with the exception of pyrite, is the most abundant mineral in the Leadville ores. Generally, the minerals are intimately mixed; but often, the sphalerite is segregated in parts of the vein to form a high grade ore of zinc. The color of the sphalerite is generally dark brown to almost black, and for this reason it is commonly called "black jack" zinc. The popularity of Leadville pyrites either in crystallized clusters and individual crystals are internationally known for their quality and large size.

ZINC: Since the discovery of the district, most of the mining was done in the oxide zone, accounting for the variety of zinc minerals in the Leadville District. **Smithsonite** is the most abundant of these minerals, and it forms as replacement bodies in the Paleozoic limestone. One variety is impure, earthy, and rich in iron; and, on the other hand, a colorless to white and sometimes a green crystallized variety is found in vugs. **Hydrozincite** probably results from the further decomposition of smithsonite. This mineral is white and soft, forming in clay-like masses. **Aurichalcite** is pale green to sky blue in color with a pearly luster. It forms as drusy coatings needle-like crystals; its occurrence was never abundant. Perhaps the most interesting zinc mineral found in this region is **calamine** which occurred rather abundantly in fine to coarse masses of bladed crystals which were found partially or completely filling cavities. Many interesting varieties of crystal are found on well developed crystallized clusters. Often it was found with **hetaerolite,** a comparatively rare manganese-zinc mineral which resembles the black botryoidal limonite to a great extent. It was first believed to be a new species and was, therefore, named "wolftonite" after the mine in which it was found. **Goslarite,** associating with other sulphate minerals, forms white coatings of fibrous masses within the tunnels of old deserted mine workings. It is formed by the leaching of descending water through sulphide zones. Upon reaching a circulation of air, evaporation takes place to cause the frost-like deposit on the tunnel walls and mine timbers.

LEAD: **Galena** is not as widespread as pyrite and sphalerite, all of which are present in the unoxidized zone. It is found crystallized in vein cavities in the form of cubes and octahedrons; sometimes many of the cubes are twinned. Analyses have shown that nearly all the galena contains antimony, and it is likely that bismuth also associates with the mineral. Throughout the district, galena carries silver, although the ratio is not constant. The silver is in sulphide form; probably argentite intergrown with galena. **Minium,** which is a brilliant red color, is found mixed with cerussite. The structure of galena is often evident in the minium. Good rich specimens are rarely obtained; the fine examples are extremely interesting. **Massicot** is an oxide of lead which is light-yellow in color and earthy in character. Like minium it is not important as an ore of lead. **Cerussite,** on the other hand, is the most widespread and important of all lead ores in the oxide zone. It generally forms directly from anglesite, and forms as large crystals, aggregates of crystals, or in disseminated masses of silica to form the "hard carbonate." Generally, all cerussite carries silver; embolite, a rich silver mineral is commonly found with the "hard carbonate" ore. **Anglesite,** is rather uncommon. When found, it is either in dull masses or glassy crystals in small vugs of galena from which it is derived. The most colorful of the lead minerals is **pyromorphite.** Frequently yellow-green or deep green crystals as much as an inch long have been secured. More often, however, the occurrence is in the form of crystal clusters in the linings of cavities. Other lead minerals

discovered in the Leadville ores are **lanarkite, caledonite, wulfenite, descloizite, vanadinite,** and an extremely rare lead silicate forming red crystals; these are insignificant from a commercial or collector's standpoint, for they were infrequently found.

SILVER: For the most part nearly all the silver in the sulphide zone is **argentite;** however, it is usually intergrown with galena, or with the rare bismuth minerals—lillianite and kobellite. There appears to be an unusual absence of rich silver minerals such as pyrargyrite, proustite, and friebergite. The prevailing silver minerals are located in the oxidized zone. **Embolite,** which often associates with ferruginous cerussite, is formed in crust-like aggregates of crystals or as solitary crystals on the cerussite. The color is generally pale green and contrasts with the colorless chloride **cerargyrite;** each contain traces of iodine. It is believed that **iodyrite** had been found in one of the mines, but definite analysis was not made at the time of the discovery. Silver minerals occurring in the oxidized zone are soft and sectile; this physical property makes their identification less difficult in the field. Pure masses of these rare minerals are very uncommon, although a mass weighing approximately 100 pounds was mined in one of the early workings.

COPPER: **Chalcopyrite** is a primary mineral of the sulphide ore, although its general habit is in the form of irregular grains in other sulphide minerals. As far as specimens are concerned, specimens of this species in good quality are rather scarce. **Tetrahedrite,** as previously mentioned, is very scarce, forming a striking contrast to localities of the southwest portion of the state, which have this mineral in abundance. In the oxidized zone, however, a greater variety of copper minerals is present. Native copper is occasionally secured associating with clay, although the quality is rarely good. **Chalcanthite** is very plentiful in the uppermost portion of the sulphide zone. At this zone it happens as scattered fibrous grains mixed with oxide and sulphide minerals. Also in the form of stalactites hanging from the tunnel walls and stopes, which is typical of many sulphates. The very fine blue-colored stalactites give the underground workings a fantastic appearance. Most of the oxidized copper ores contain rich indications of malachite and azurite, but material of good quality is totally absent.

BISMUTH: The presence of bismuth in practically all of the sulphide ores probably accounts for concentration of this element with other elements to compose a very interesting yet troublesome series of bismuth sulphide minerals. Bismuthinite is the only mineral definitely established. A strange bismuth mineral was believed to be **kobellite** for some time; however, the absence of antimony was evident. The fresh material had suitable physical properties with a steel-gray color and dark streak, but the absence of antimony with a variable silver content indicated a new mineral species. It was named **lillianite** after the Lillian Mine. In the oxidized zone bismutite was found in the ores rich in bismuth. Since small kernels of lillianite are found associated with bismutite, it is evident that oxidization was directly from this sulphide mineral.

In a region with such a diversity of mineral species, it is logical to expect numerous unexpected mineral varieties. The finding of native arsenic, scheelite, and wolframite has been made throughout the area in small amounts. Manganese minerals are very abundant in upper works in the form of pyrolusite and psilomelane. They were evidently derived from the very rare black manganese sulphide **alabandite,** which has a distinct cubic cleavage and a green streak.

GOLD: As a general rule the association of gold with other minerals is microscopic. Nevertheless, gold in bright films was often found with dark sphalerite. Wire and leaf gold was found very abundantly in oxidized

zones of various mines. The abundance of gold in many parts of the oxide zones throughout the great vein system of the Leadville district accounts from the rich placer gold made in California Gulch during the early days of the camp.

Today the region is practically inactive. Individual leasers are operating and making most of the production at the present time. The sulphide zones are rarely worked, since at depth the mines are flooded with water, making operations an expensive procedure. Placer operations in California Gulch are practically not in existence as the gravel material, which originally was not extensive, was worked over intensively in the past. The possibility of securing good specimens at the mines is not likely since the choice material was secured during the boom days. Such an incident is typical of all mining districts. The town of Leadville itself is magnificently interesting with its picturesque rough-and-ready buildings and its bordering landscape of snow-tipped treeless peaks.

COSMOPOLITAN SPECIMENS

By PETER ZODAC

We are pleased to advise that the previous record of ten different mineral species in one specimen has been broken twice. Mr. Allen Heyl, Jr., R. F. D. No. 2, Allentown, Penn., submits the following:

"About 5 or 6 years ago, I collected a 2x3 inch specimen near Phoenixville, Penn., which contains the following minerals in order of their abundance:

1. Quartz:—massive and small crystals.
2. Pyrite:—crystallized and massive.
3. Fluorite: — numerous colorless cubes.
4. Galena:—many small masses.
5. Sphalerite:—a mass of some size at one end with quartz and calcite.
6. Chalcopyrite:—several masses.
7. Ankerite: — brownish with quartz.
8. Calcite:—with sphalerite.
9. Smithsonite:—silky tufts in many cavities with fluorite etc.
10. Limonite:—stains, numerous.
11. Pyrolusite:—tiny specks and dendrites on large flat areas of quartz.

(Malachite is also present in microscopic coatings on chalcopyrite).

"The second specimen, 3x3 inches, is from Avondale, Penn., and the minerals in order of their importance are:

1. Albite: — white, translucent cleavages.
2. Orthoclase:—pale pink cleavages.
3. Muscovite:—plates.
4. Beryl: — very pale yellowish masses and tiny crystals.
5. Rubellite:—pink.
6. Chalcopyrite: — several small masses.
7. Quartz:—a few small masses near the beryl.
8. Chrysocolla:—blue-green stains.
9. Bornite:—purplish-brown, coating chalcopyrite and also small specks with chrysocolla.
10. Limonite:—Numerous stains.
11. Pyrolusite:—small dendrites in a hollow.
12. Biotite: — a few very tiny specks, almost microscopic."

It may be some job in trying to exceed the number of mineral species in the Avondale specimen collected by Mr. Heyl but if any reader has a specimen which may surpass it will he kindly write in, describing what he has? Remember this is not to be a microscopic examination but only such as can be seen with the naked eye. But the specimen must not exceed 3x3 inches in size.

UNUSUAL OCCURRENCE OF HALITE

By KIRIL SPIROFF

Salt (halite) is a very common mineral, but when large quantities of it were recently found in the 85th level of the Quincy Mine, Hancock, Michigan—a copper mine located in ancient lava flows far removed from sedimentary strata known to contain halite—then it is believed the unusual occurrence and the mineral is worthy of description.

The Quincy is one of the large amygdaloidal copper producers in Michigan. It attains a depth of 9,009 feet as measured along the incline; this is equal to 6,254 feet measured vertically. The 85th level where the salt is found is about 8,000 feet along the incline, or over a mile in vertical depth. The drift is a ventilation passage subjected to a continuous air current and as such is an ideal place for evaporation to take place. The part where the salt crystals are found has not been used in mining operations for the past six years, thus giving the mine waters ample time to evaporate and to form crystals.

It has been known for a long time that the deep mine waters of the Michigan copper mines contain sodium and chlorine along with many other rare salts, but this is the first time halite has been found in large quantities. Small amounts have been reported from the 9th level of the South Hecla, a conglomerate mine in which native copper is mined from a mineralized ancient sea beach. On the other hand, Quincy is an amygdaloidal mine; that is, native copper is there mined from mineralized brecciated tops of ancient lava flows.

The part of the 85th level where the halite is abundant has a particularly striking appearance.. All the surfaces are covered with halite, and the white material stands out against a background of green traprock. Red copper and also the copper stains of light green and blue lend a beautiful background to the dead white of the salts, which have an appearance similar to that of the calcium carbonate found in limestone caves.

Large white stalactites hanging from the roof are brought into the flickering path of the carbide lamp of the miners. The walls are literally covered with minute delicate crystals —crystals so fragile that even a slight breeze loosens them from the walls and produces what appears to be falling snow. The floor is made up of small yellowish pools; as one wades through them, he hears the salt crystals crunching underfoot and in places stumbles against stalagmites of the crystals rising from the floor.

The salt crystals are pure halite as revealed by both chemical and X-ray analysis. Some impurities are found in the outer layers, but these are very easily washed off. The largest crystals are in the form of one-inch cubes, many of which have their corners truncated to form what is known as octahedral faces. The small needle-like crystals show very interesting phenomena. Although they are long, they still retain square terminations; this indicates that they are distorted cubes—precisely what one would anticipate from material of the isometric system. All the crystals have salty taste, perfect cubic cleavage, hardness of 3, and specific gravity of 2.11. The low gravity is probably due to air bubble inclusions. Most of the material is coated with a yellow-reddish mine sludge that washes off very readily, leaving the crystals pure white. There are also other encrustation, some red in color, others green; but not enough of these have been collected for determinative work.

RECAPITULATION

One Year's Experiences in Mineral Collecting

By WALTER P. SACHS

Just about one year ago, as this is being written, I became interested in mineralogy to the extent that I wanted my own collection of what I have since considered mirrors of Nature's perfectibility. While the result of a year's collecting may be classified, at best, as a rather haphazardly selected group of mineral specimens, I was not wanting in deliberateness in choosing the hobby.

Realization of an aesthetic appeal combined with the exactness of a science, inherent in fine collections, first thrust itself upon me when I beheld the collection of a friend, Ernest H. Wilson of Caldwell. Probably the color in an organized arrangement of these products of Earth's crucibles made the first appeal to my faculties. Closer examination must have revealed the regularity of form of many of the mineral specimens. At any rate, the two qualities—gorgeous colorings and regular conformations — were sufficient to accost a sense of the beautiful. They comprised the first aesthetic stimulation. Merging with this appeal, after a bit of exposition, was the sense of orderliness, first qualification of a science. In what other hobby, I must have reasoned, would one find a coupling of these characters—aesthetic and scientific—in such abundant measure?

So the idea of assembling my own collection was born. I was barren of all knowledge of mineralogy; I couldn't identify a quartz crystal or, with any certainty, say: "This is pyrite—that is gold." But I did have sense enough to realize the eye-filling, knowledge-seeking possibilities when a hobby swam into my ken. And it is of this quest, of this and that done in the pursuit of a hobby by a rank beginner, that I propose to deal. I cannot write of a new species, a new locality, or even of an unusual find. It would be presumptuous of me to attempt anything but an informal narration of my first year's experiences.

J. A. GRENZIG, 299 Adams St., Brooklyn, N. Y.

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Of Books Read.

Fortunately when I started a collection, under the aegis of Mr. Wilson, I had in him a generous and more-or-less exacting teacher. I recall that the first work on mineralogy he loaned me, adapted precisely to my purpose, was Hawkins' "The Book of Minerals." It provided a sweeping, comprehensive glance at the mineral kingdom. Then came English's "Getting Acquainted With Minerals," through which I developed a partial foundation on which to build, at the same time obtaining a nodding acquaintance, at least, with several species. It was the latter work, too, which introduced me to the splendid magazine which you now are reading. An old "System of Mineralogy" became mine and I continued my avid, if not entirely understanding, reading through Dana's "Textbook" and Manchester's "Minerals of New York City."

I was progressing! Palache's "The Minerals of Franklin and Sterling Hill, Sussex County, New Jersey" and Slawson's "The Fluorescence of Minerals" were acquired. I purchased copies of Dana's "How to Study Minerals," an atlas, a chemistry text, and a couple works to give me a geological background. What I am trying to stress, however, is not that the mere reading of these several works gives one a complete understanding of mineralogy. Rather, I was groping for the fundamentals of the science. Zodac's "How to Collect Minerals" came later as did Whitlock's "The Story of the Gems."

Of Specimens Acquired.

In a cabinet of drawers, obtained shortly after, there soon gleamed a pyrite, a fluorite, several varieties of quartz, a franklinite and a natrolite. These constituted my first prideful acquisitions—and with what care I handled them, with what anxiety I placed them in trays and labeled them, with what delight I read all I could about them!

Although eager to go out and collect specimens myself, it was still too early in the year; the vicinity was in the clutches of Winter. I had to content myself with modest purchases from Ward's Natural Science Establishment and R. W. Tuthill—my first two. No miser ever gloated over his gold the way I viewed these first purchases! Later I recall making trips to John A. Grenzig's in Brooklyn, to William C. Casperson's in Paterson.

When finally the Winter gave way to balmier weather, there came my first mineral collecting trip. It was to the New Street Quarry in Paterson where I obtained prehnites, chabazites, calcites, quartzes, aragonites and pectolites. As is natural with every beginner, I suppose, there was little concern shown with the quality or size of the minerals; they were specimens, and that's what I was after. I came home laden with as much of the mineral kingdom as I could transport. There followed trips to Montville, Great Notch, other quarries in and around Paterson, and to Franklin. But there was by now

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seeping into my knowledge of minerals a definite plan of collection. At first it was somewhat disquieting to realize that perhaps those last specimens you brought home were not so hot. I abandoned most of the haphazard collecting and confined myself as far as possible to good crystallized specimens of a certain size. This was not always possible, of course, but at all events, order was replacing a bit of the chaos.

Naturally, that bugaboo of all collectors—lack of space in which to place minerals—reared its ugly head in my case too. I was forced to purchase a larger cabinet soon. I found early, too, that interested friends who know little of minerals can contribute vast quantities of worthless material. In one case, however, I struck a friend who, while not interested personally in collecting, brought some worthwhile specimens from a transcontinental automobile tour.

To recapitulate, then, I today have 166 specimens which I think are worthy of my cabinets. Many of these, I hope, will be superseded by finer specimens eventually. They represent several duplications in some species. I have a mass of material in a cellar cabinet, some of it fair, which was collected mostly in the not-so-distant days when I grabbed first and considered later. I gaze upon these, my youthful errors, and wonder!

Perhaps we may weigh in our hands some of my specimens, chosen at random. Virtually the speed of light would be required to visit all the localities represented in the same time it takes to read the labels. We may conjure up the frozen wastes of Iceland, the torrid heats of Africa, and any number of intermediate spots from which minerals have been wrested. Here's a rich silver from Cobalt, Ontario. Further down the Dana classification we come to a pyrite from South River—minute crystals that show colorfully under the microscope. There's a boulangerite from Stevens County, Washington. We might pick up next this grouping of greenish cubes, fluorite from Cumberland, England, which shows its

MOONSTONE

We have some very nice Moonstone showing lots of color. About half the specimens are white, the rest are the more uncommon smoky variety. They make handsome little specimens either rough or with one side polished. ½" 10c; ¾ to 1" 15c; 1 to 1¼" 25c.

CHABAZITE

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characteristic gorgeous blue under the activation of ultra-violet light. The quartz group passes before our eyes: Herkimer County "diamonds," an amethyst group I found in Paterson, rose quartz from near Rapid City, South Dakota, and other varieties. Here's a hematite "kidney ore" from Cumberland, a colorful limonite from Salisbury, Connecticut, sharp crystals of magnetite from French Creek. There's a doubly refracting cleavage of Iceland spar, and, totally different, some siliceous crystals of calcite from Bad Lands, South Dakota. Next we might fondle that twinned orthoclase from Goodsprings, Nevada, or examine the play of color in that labradorite from Friedrichsvarn, Norway. See that babingtonite crystal sitting up on calcite from Paterson. Ah! Here's gorgeous green dioptase from Guchab, S. W. Africa, and topaz from San Luis Potosi, Mexico. Nice large crystals of datolite from Paterson and hancockite in tiny crystals from Franklin parade before us. Zeolites soon follow: apophyllite from Paterson—note the pearly and vitreous lusters. Don't touch the delicate mordenite from Custer County, Idaho! Stilbites, there are, from Berufiord, Iceland; Great Notch and Upper Montclair, as well as pastel-colored chabazites from Paterson. There are micas: muscovite, lepidolite, biotite, phlogopite, from South Dakota, Connecticut, Ontario and Franklin. Smooth-feeling talc from near Providence, Rhode Island, engages the eye. Note that botryoidal chrysocolla from Yerington, Nevada, and those nice crystals of descloizite, a bit later, from Olifontsfontein, S. W. Africa. Priceite from Inyo County, California, is followed shortly by a nice anglesite from Monte Poni, Sardinia.

And I learned about geography from minerals!

Of Equipment.

A primary consideration in setting up a collection was, for me at least, the housing of that collection. My first purchase was a wooden chest of seven drawers. It was not designed for minerals and since the drawers were too high, about half the space was simply wasted. Later I purchased a filing cabinet with drawers about three inches high. I suppose I was fortunate in finding a cabinet of twenty-seven drawers into each of which fit precisely fifteen trays of two sizes, obtained from Ward's. Needless to say, I now have room for considerable expansion.

Among other early purchases of equipment were a doublet, a pocket magnifier of lesser magnification, and an argon bulb. More recently I have acquired a microscope—small, it is true, but well enough adapted to the examination of micro-mounts for a beginner. The microscopic examination of minerals, however, remains largely an undeveloped field in my knowledge of mineralogy. Aside from a half-dozen micro-mounts prepared myself and a couple high-ring mounts purchased, the microscope is too recent an acquisition to report further on at this time. In the course of a year, I have acquired also, besides the inevitable chisel and hammer, other magnifiers and the usual requirements for preparing micro-mounts.

Of Collections Visited.

Among the larger collections I have visited, always with an eye to the surpassingly beautiful specimens taken from their natural settings to gild the museums, are those of the American Museum of Natural History, the Paterson Museum and the Newark Museum. I have seen several private collections, outstanding of their type, since my first sight of Mr. Wilson's aggregation of minerals originally evoked the desire to have one of my own.

Uniformly, I found mineralogists always eager to help a beginner. There was Mr. Carl Dauterman of the Newark Museum who pointed out a greenockite crystal for me when I had doubts that one actually existed in a specimen on view at that museum. There was Mr. James Morton of the Paterson Museum who gave me some hints to identify a specimen I had obtained from Great Notch. There was Mr. Grenzig, glad to demonstrate his fluorescent cabinet. There was Mr. P. Walther of Elizabeth, who was ready to show me his collection with minerals from all parts of the earth. There was Dr. E. P. Henderson of the United States National Museum, who imparted some of his philosophy of mineral collecting. There was Mr. Casperson very willing to point out a crystal cavity after anhydrite.

There was Allan Caplan of Boulder, Colorado, visiting the East, who showed me wonderful gold and silver minerals. There was Dr. L. H. Bauer of Franklin, who showed a cahnite crystal. There was Mr. William Ball of Franklin, ready to indicate the difference between a spinel and a franklinite crystal. There was Peter Zodac who welcomed me into the mineral collecting fraternity with a cordial letter.

Many of these men may not even recall having aided me. Nevertheless, this is my token of appreciation to them and to Mr. Wilson who took me to see most of the mineralogists.

I have, then, been collecting minerals for one year.

I am still virtually barren of knowledge of minerals!

One of the most common of minerals in New York State is rock crystal. It is found in many of the counties in mines, quarries, rock exposures, stream beds, and in small vugs of glacial boulders. Some very interesting specimens have been found lately at the feldspar quarries of Bedford, Westchester County.

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COAL, ITS ORIGIN, PRODUCTION, USES, AND BY-PRODUCTS

We seldom stop to consider the economic significance of our mineral fuels, of which coal is by far the most important, or the part they play in our daily lives.

This major role of coal is usually not appreciated, contends John R. Bradley of the Coal Economics Division, United States Bureau of Mines, Department of the Interior. He points out its outstanding importance to the comfort and convenience of our homes and to the development and continued operation of our industries, as well as its place as a basis of many of the luxuries of life.

The original source of all energy or power is the sun. Its rays heat the air and set up currents which furnish power to windmills; they strike the sea causing evaporation which is carried away by the winds to fall as rain that finds its way to lower levels where it furnishes power for water wheels; and finally, when the sun's rays fall on green vegetation, cellulose is formed.

Most of our best coal deposits were formed soon after luxuriant vegetation first began to clothe the dreary, barren land surfaces of the earth some hundreds of millions of years ago. Vast fresh-water swamps similar to the everglades of Florida, but with even more luxuriant growth of primitive fern-like plants and trees, stretched through thousands of square miles where our coal beds now lie. A slowly-sinking land permitted these swampy conditions to continue over centuries of time, during which the dead trees and plants accumulated to vast thicknesses—up to a hundred feet or more. At times the land sank at such a rate that the salty ocean water invaded the areas, killing the vegetation and depositing sand and clay over the thick accumulation of peaty material. This process repeated itself many times, giving rise to planty accumulations at different levels with beds of sands and shale in between. As these materials became more deeply buried, increasing pressure from the weight of the overlying deposits compacted the peaty material into less than a tenth of its original thickness, so that what is now a five-foot bed of bituminous coal probably required well over 50 feet of dead plants and trees for its formation. Progressive increase in pressure due to deeper burial, helped by other pressure brought about by gentle crustal movements in the earth, raising the areas high above sea level, eventually gave us our vast Appalachian and interior bituminous coal beds, lying almost flat. Where more severe folding and crushing of the crust took place, with vastly greater pressures, the coal was further transformed into anthracite which is found in rather steeply titled beds.

Such coal-forming processes have been repeated during the past hundred million years, but these younger coal beds are generally of much poorer quality, being the lignites of the West and Gulf coast. In fact, vegetation is now accumulating in vast swampy areas over parts of the earth in such quantities as to give rise to more coal beds perhaps a hundred million years from now.

The greater part of the energy generated in the United States is derived from coal.

The United States is fortunate in the size of its coal reserves. With one-fourth of the world's area and one-fourth of its population, the British Empire has less than a fourth of the world's coal resources; the United States has about onehalf of the world total. Normally we account for more than one-third of the world production, and its cost at the mine is less than that of either of the next two largest producing countries.

The value of all coal mined in the United States up to 1936 has been estimated at $41,271,000,000, about six times the value of all of the gold and silver mined during the same period.

If there were no coal in the United States, and none imported, more than half a million coal miners (not to mention those engaged in collateral industries and trades, such as the railroads and the retailers and wholesalers) would be dependent on other sources of employment. The market for vast supplies of iron and steel products, timber, lubricants, and explosives—to name only a few commodities, the estimated purchases of which by the coal industry reach some $200,000,000 annually — would be non-existent. Ten times that amount of capital would have to look for other investments.

Coal accounts for 40 per cent. of the total freight carried on our railroads and for about one-fourth of the total revenue. The interchange of the products of a region with those of another region of this vast country is facilitated by cheap transportation, represented in general by our railroads, and cheap transportation is made available through the use of coal. The coal consumed by railway locomotives in a typical year is approximately equal to the production of one man working 23,800,000 shifts.

Originally coal was used solely as a fuel. Today coal tar, derived from coal, is the basic material for a long list of products, valuable alike in the sciences, in war, and in peace.

From a ton of bituminous coal there may be produced about 1500 pounds of coke, mainly used in releasing ores from their matrix; 10,000 cubic feet of gas, chiefly used for heating and lighting and from which sulphur is recoverable; 22 pounds of ammonium sulphate, the nitrogen of which is one of the important fertilizers; 2½ gallons of benzol, that can be used in internal-combustion engines; and 9 gallons of tar, from which a host of products are obtained. The products include aspirin for headache; acetanilide, for colds; codeine, a pain reliever; photographic and flavoring materials; saccharin, 500 times sweeter than sugar, an aid to diabetics; and perfumes and dyes that compete with products of nature. As a high explosive, T N T or tri-nitro-toluol is perhaps best known.

Without coke, used almost universally in the metallurgical industries, we would be but a step removed from the stone age of some 5,000 years ago.

Coal plays an important part in our domestic as well as our industrial life. Aside from heating our homes, coal, or coke from coal, is used in the fabrication of metals necessary in the construction, furnishing and outfitting of a house, such as structural steel, steamfitting and plumbing supplies, and all metal fixtures and supplies down to nails, and in the manufacture of metal furniture, cooking utensils, and other articles too numerous to mention. Coal gas is used to fuse the sands or clays in the manufacture of window glass, porcelain, and china. Coal tar products enter into the composition of roofs, preserve the timbers in the house, waterproof the basement, disinfect the drains, protect our garments from vermin, and find use as a refrigerant in ice making. Minute particles of coal are used in telephone transmitters.

Of all of the thousands of minerals in the earth's crust, it is difficult to think of one as important as—coal.

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INSPECTION OF WORK IN PROCESS

The question of what amount of magnification we amateurs should use in the examination of faceted gems in process can be answered only after a decision is reached as to **why** we polish such gems. We must leave the professional out of this discussion. The considerations that prompt him are different from those that we should take into account. The work is his bread and butter. It is up to him to turn out as much of it as he can in a short time as possible and of a quality such that it will be saleable.

Some time ago a paper was published describing in detail how to do **easily** a certain piece of ordinarily difficult polishing. The statement was made that the results obtained by the advocated method was "a high polish, free of scratches when viewed with a 4 x glass."

This put me wondering why an amateur should use a 4 x glass. For the commercial examination of gems a 7 x to 10 x glass is standard. But we avowed we were not going to discuss commercial aspects of the matter.

What is our chief reason for cutting faceted gems? It is not for the purpose of building up a collection of typical cut gems at a minimum cost for if we place any value on our time gems of our own cutting cost far more than we would have to pay to have the work done in certain foreign countries. I think our chief reason for cutting them is to prove to ourselves that we **can do it.** The urge is, pride of accomplishment. If this reasoning is correct, and we take a certain pride in accomplishing the job, shouldn't our satisfaction in the result be in proportion to the fineness of the workmanship? It not only "should be"—it "is," as every worker knows. A 4 x magnification is not conducive to fine workmanship and I believe should be condemned for that reason.

This doesn't mean in the least that a 4 x magnification will not often result in a very passable gem. It depends greatly. White gems with much brilliancy can carry without detection scratches that would be ruinous in a very dark colored stone. But again we come dangerously near commercialism in the discussion. It shouldn't be freedom from detection that we seek, but freedom from scratches that **we know** are present though no one else may ever see them. The chief object in seeking this perfection being to increase our

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own pride and satisfaction in our work.

I wish I could lay claim to always practicing what I preach. I do not. Sometimes I want to see how quickly I can do some certain job in a presentable manner. On other jobs I may stop short of perfection with a, "that's good enough" feeling. But I have cut enough **good** gems to have learned the feeling of superior satisfaction that comes with a close approach to perfection. This ideal costs time. It will take from 50% to 100% more time to cut and polish a stone **well** than would be required if we wanted it merely to "get by."

But "satisfaction" is what we are primarily wanting—not the cut gem. We could probably buy for fifty cents the stone that will take two hours of our time.

I think one feature that tends to lower our standard of finish is that there are so many decisions to make on each job. If the included work were all on a single face and one could see it progressing from rough to smooth to fair polish to fine polish, only a few decisions would have to be made on each job and these nearly at the finish of the job, and the decisions would be merely "to stop now or to continue a little longer."

But in cutting a standard brilliant with 57 facets we have 114 decisions to make after the stone is roughed out. On each facet we must decide when it is cut enough and then we must decide when it is sufficiently polished. I think that in doing any particular stone, if we pass up a single facet, knowing it is not right, we will very probably turn out a quite inferior stone because on all facets after that "slighted" one we will either consciously or unconsciously reflect, "That facet was rather poorly done—no use wasting time on this one because the gem now can't be a perfect one."

I recognize fully the "grief" that can come with a single obdurate facet. I am wholly familiar with the profane or obscene thoughts and even words that can be brought out by the facet that refuses to polish but that scores, tears and scratches until it is far overcut. And when this happens I agree that it is useless to waste time in an attempt to attain perfection on the remaining faces.

But in general—work toward perfection on a few gems. If you have not been doing so it may give you a real thrill.

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MICRO-METHOD FOR DETERMINING THE HARDNESS OF MINERALS

By EUGENE W. BLANK

Recently the writer described a micro-method for determining the streak of minerals (1). The hardness likewise is a valuable aid in the identification of a mineral for the approximate hardness of a specimen can be very easily determined. In many cases it is almost impossible to apply the hardness test because the mineral is either too small, or as often occurs in the case of crystals, is rendered impossible by the resulting disfigurement of the specimen. By proceeding as directed in the earlier paper (1) it is possible to overcome these difficulties.

Mohs's scale of hardness is so familiar as to render it unnecessary to reproduce it here (2).

Procure small pieces of the various minerals mentioned in the hardness table and break or chip them into small sharp pieces about ¾ inches long by ⅛ inch wide. The pieces need not be larger. The pieces should preferably be square at one end with a sharp point at the other.

File back the points of an old ruling pen (mechanical drawing pen) until the thick portion of the metal is reached. Finally roughen the inside of the pen blades. If possible file a deep V shaped groove in each blade extending backward from the filed edge parallel with the long direction of the pen blades for about ¼ to ½ inch. Insert one of the small pieces of mineral, depending upon the expected hardness of the specimen under test, between the prepared blades of the pen and tighten the thumbscrew on the pen until the mineral is firmly held in position.

The hardness of the specimen under test is determined as in the usual manner by making a short (1/50 inch) scratch on the specimen with the sharp point in as inconspicuous a place as possible and examining the specimen for scratching under a strong lens in a good light or under the low power of a microscope by reflected light. Distinguish carefully between a scratch and a chalk mark. The latter is easily removed by rubbing.

Very small specimens or particles of mineral material should be fastened to a glass plate or tile by means of Canada Balsam for convenience in firmly holding the specimen while making the test. The specimen can be subsequently removed from the glass by means of alcohol.

It is inadvisable to use this method at the extreme ends of the hardness scale (Talc and Diamond). Thus Talc is too soft to be mounted in the pen holder while in the case of Diamond it is more economical to purchase one of the laboratory "glass writing" pencils which can be procured for a nominal sum from any laboratory supply house.

(1) Rocks and minerals, 12, 88 (1937).

(2) Kraus, Hunt and Ramsdell, "Mineralogy," 3rd Edition, p. 100, McGraw Hill Book Co., Inc., New York (1936).

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Seattle, Wash.—I enjoy *Rocks and Minerals* very much but wish we might get a few more articles about the *Pacific Slope.* —H. Sykes.

A Booster of Peekskill!

E. Cleveland, Ohio—I want to congratulate you on your taste in picking your home town for publishing *Rocks and Minerals.* My family and I took a two week trip through the East, three years ago. Coming back we passed through Peekskill, up the Hudson River, and across Bear Mountain Bridge. And *your* section of the country stood first in point of scenery of any place on the trip. Not the wild, rugged type of beauty so prevelant in the Rockies but an older, more mellow grandeur that had a distinction all its own. Typical "down East" Yankee dignity might be the way to express it. But anyhow it made itself a place in our memory. Someday we will see it again.—M. Knowlton.

May It Live Forever!

Terlingua, Texas—*Rocks and Minerals* is one magazine that is doing something worth while. Nothing can, in my opinion, take its place as to its real educational value. It it filling a place in a field that has been long needed. May it wax fat, sassy and live forever.—Frank Duncan.

Bull No. 2 of Great Help!

Oklahoma City, Okla.—I have just finished reading your book *How to Collect Minerals* and thoroughly enjoyed it. It will be of great help to me.—Joe C. Rogers.

R. & M. Appreciated!

Helena, Mont.—Let me congratulate you on the very interesting articles published in *Rocks and Minerals,* especially those written by A. J. Harstad and M. R. Thompson. I can assure you of my continued support as a subscriber to your very excellent publication.—Emil Starz, Sc.D.

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A VISIT TO AN AMBER MINE IN EAST PRUSSIA

By MISS GERTRUDE SCHMIDT, R. N., Castle Point, N. Y.

On a recent visit to my people in Germany, during the summer of 1936, I resolved to make a special effort to also visit the amber mine at Palmnicken, East Prussia. I used to live near Koenigsberg, East Prussia, and it was from that city that I entrained for Palmnicken.

On arrival at Palmnicken, I made inquiries at the railroad station regarding the mine and some smokestacks were pointed out to me as being at the workings. The distance not being far, I took the nearest road and in due time reached the mine and the office.

There were several people waiting at the office on the same errand as my own and I joined them. First we were taken to a show room where we saw many fine specimens of amber — polished and rough — with and without inclusions. Specimens of petrified wood were also on display. The salt water test for identifying amber was demonstrated to us. In this test, if amber is placed in a saturated solution of common salt it will float. A miniature model of the whole workings was also displayed and we could see how the amber was actually mined with steam shovels and dredges with buckets and how it was extracted from the blue bituminous earth by a series of sluices.

From the show room we were taken to the edge of the mine workings, a huge pit which lies in a flat to gently rolling plain about a mile from the Baltic Sea. The diggings, unfortunately, had progressed too far away from where we were standing so that close examination was not possible. We were not permitted to go nearer and I was much disappointed as many details were missed. And there was no opportunity in picking up even a tiny fragment of amber. But we could see the steam shovels and dredges working in the distance in the layer of blue earth which extended upward to within 50 feet of the surface.

We returned to the show room where I purchased some pictures of the mine and then left for Koenigsberg.

The remainder of my vacation was spent mostly on the shore of the Baltic Sea, at Kahlberg, a little fisherman's village and a summer resort. On the beach there, in fact all along the shore from Poland north to Lithuania, one may pick up tiny pieces of amber. Large pieces are often washed in from the sea during storms but are hard to find as they are soon picked up by the fishermen who comb the shores pretty thoroughly and who sell their finds to the government. The whole amber industry is now under government supervision.

Pieces of amber are occasionally picked up by farmers further inland while ploughing and tilling their fields. These pieces have apparently been transported inland by glacial action.

At Kahlberg, I bought a few polished amber trinkets to bring back to America, among them was an 18-inch string of clear, light-colored faceted beads which fluoresced nicely under the argon bulb.

The amber I picked up from the beach varies from very light, opaque and clear yellow to nearly black and are about the size of rice grains. A few of them have inclusions of some foreign substance but no insects nor even parts of them, and no bubbles either. A few fluoresce a green color, more or less bright, especially on the freshly broken surfaces, under the argon bulb.